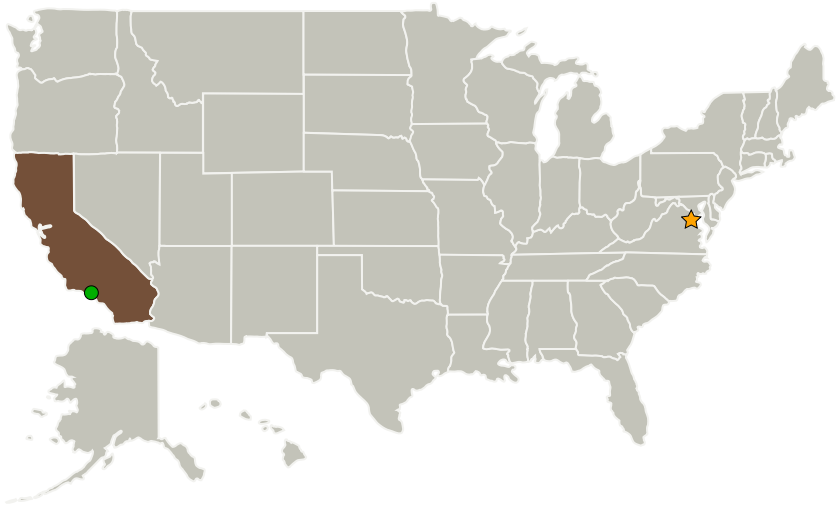
Ka Band Highly Constrained Deployable Antenna for RaInCube

Completed Technology Project (2015 - 2017)

Project Introduction

Precipitation radars in Low-Earth-Orbit (LEO) provide vertically resolved profiles of rain and snow on a global scale. Nevertheless, observations available from LEO platforms are sparse in time, and they do not allow the observation of short time scale evolution of most atmospheric processes, nor do they properly sample the statistics of the diurnal cycle within short temporal windows. CubeSats and SmallSats enable cost-effective deployment of multiple copies of the same instrument to achieve these goals. As part of a JPL R&TD initiative called RaInCube (Radar In a CubeSat), we have demonstrated the feasibility of a Ka-band precipitation profiling radar instrument in a 10x10x20cm3 volume, excluding the antenna. For optimum synergy with the Global Precipitation Measurement Mission Dual-Frequency Precipitation Radar, 5km radar footprint is desired, requiring a 0.75m aperture size from 400km LEO orbit. The primary goal of this ACT proposal is to design, fabricate and test a 0.75m aperture reflector antenna with 45dB of gain at 35.7GHz that occupies less than 2.5U volume (10 x 10 x 25 cm3) when stowed for launch, bringing the complete radar instrument to TRL 5, thus paving the way for a flight demonstration of RaInCube in a 6U CubeSat (RIC-6U). In order to achieve a compact design with higher efficiency in the presence of blocking from the sub-reflector, we will use an optimized Cassegrainian antenna geometry with a shaped sub-reflector or a sub-reflectarray to partly compensate for the main reflector distortion. As a secondary goal, we will investigate a range of more capable antennas (i.e., larger, scanning and/or multi-frequency) suitable for a 50kg SmallSat platform (RIC-S50) with antenna stowed volume 20 x 20 x 50 cm3.

Primary U.S. Work Locations and Key Partners



ALHAT - ETD Autonomous Landing & Hazard Avoidance Tech Earth Science Technology Office

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Organizations Performing Work	Role	Type	Location
★NASA Headquarters(HQ)	Lead Organization	NASA Center	Washington, District of Columbia
●Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California
University of Southern California(USC)	Supporting Organization	Academia Asian American Native American Pacific Islander (AANAPISI)	Los Angeles, California

Primary U.S. Work Locations
California

Images

91-1373479894122.png
ALHAT - ETD Autonomous Landing & Hazard Avoidance Tech Earth Science Technology Office
(https://techport.nasa.gov/image/5102)

Organizational Responsibility

Responsible Mission Directorate:
Science Mission Directorate (SMD)

Lead Center / Facility:
NASA Headquarters (HQ)

Responsible Program:
Advanced Component Technology Program

Project Management

Program Director:
Pamela S Millar

Program Manager:
Amber E Emory

Principal Investigator:
Yahya Rahmat-samii

Co-Investigators:
Richard E Hodges
Eva Peral
Kim M Duiker
Mark W Thomson
Jonathan F Sauder
Simone Tanelli

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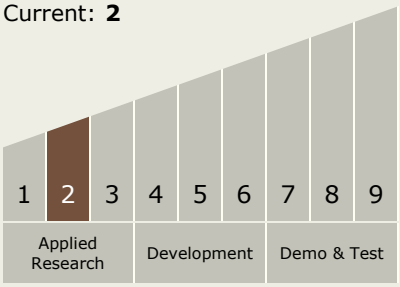
Technology Maturity (TRL)

Start: **2**
Current: **2**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.4 Microwave, Millimeter-, and Submillimeter-Waves

Target Destination

Earth